

What is claimed is:

1. A control valve system comprising:

a housing defining an inlet, an outlet and an exhaust, said inlet being

5 adapted to receive pressurized fluid;

a first movable valve unit including a first exhaust poppet and a first inlet poppet, wherein said first exhaust poppet is movable between an open position for coupling said outlet to said exhaust and a closed position for isolating said outlet from said exhaust, wherein said first inlet poppet is movable between an open position for
10 coupling said outlet to said inlet and a closed position for isolating said outlet from said inlet, wherein said first movable valve unit is movable to an actuated position, a deactuated position, and an intermediate position, wherein said actuated position comprises said first inlet poppet being in its open position and said first exhaust poppet being in its closed position, wherein said deactuated position comprises said
15 first inlet poppet being in its closed position and said first exhaust poppet being in its open position, and wherein said intermediate position comprises said first inlet poppet and said first exhaust poppet both being at least partially open;

a second movable valve unit including a second exhaust poppet and a second inlet poppet, wherein said second exhaust poppet is movable between an open
20 position for coupling said outlet to said exhaust and a closed position for isolating said outlet from said exhaust, wherein said second inlet poppet is movable between an open position for coupling said outlet to said inlet and a closed position for isolating said outlet from said inlet, wherein said second movable valve unit is movable to an actuated position, a deactuated position, and an intermediate position, wherein said
25 actuated position comprises said second inlet poppet being in its open position and said second exhaust poppet being in its closed position, wherein said deactuated position comprises said second inlet poppet being in its closed position and said second exhaust poppet being in its open position, and wherein said intermediate position comprises said second inlet poppet and said second exhaust poppet both being

at least partially open;

first and second crossover chambers communicating with said second and first inlet poppets, respectively;

first and second flow restrictors coupling said inlet to said first and second crossover chambers, respectively; and

first and second pilot valves disposed at one end of said first and second movable valve units, respectively, for selectably urging said first and second movable valve units to said respective actuated positions;

wherein when one of said first and second units is in said deactuated position and said pressurized fluid is removed from said inlet then substantially no net forces act on said one unit and it remains in said deactuated position, and when said pressurized fluid is restored to said inlet then said one unit is urged into said deactuated position in response to pressure resulting from fluid flow into a corresponding crossover chamber via a respective flow restrictor.

2. The control valve system of claim 1 wherein said first and second movable valve units are shaped such that said pressurized fluid in said inlet produces forces acting on said first and second valve units with substantially no components in an axial direction of said first and second movable valve units.

3. The control valve system of claim 2 wherein portions of said first and second valve units exposed to said pressurized fluid in said inlet are cylindrically shaped with a substantially constant diameter.

4. The control valve system of claim 2 wherein said first and second flow restrictors comprise first and second shoulders on said first and second movable valve units, respectively, each shoulder having a respective inlet side with a respective surface area exposed to said inlet, and wherein said first and second movable valve units include first and second piston surfaces opposing said first and second shoulders,

respectively, and exposed to said inlet, said first and second piston surfaces providing respective surface areas equal to said surface areas of said inlet sides of said respective shoulders.

5 5. The control valve system of claim 1 wherein when one of said first and second units is in said actuated position or said intermediate position and said pressurized fluid is removed from said inlet then said one unit is prevented from moving into said deactuated position.

10 6. The control valve system of claim 1 wherein when one of said first and second units is in said actuated position or said intermediate position and said pressurized fluid is removed from said inlet then said one unit is prevented from moving into said deactuated position, and wherein when said pressurized fluid is restored to said inlet then said one unit is urged away from said deactuated position in
15 response to pressure built up in a respective crossover chamber.

 7. The control valve system of claim 6 wherein when said pressurized fluid is removed then said one unit is prevented from moving into said deactuated position at least partially by friction and at least partially by gravity.

20 8. The control valve system of claim 1 further comprising:
 first and second return springs for urging said first and second movable valve units from said actuated position into said intermediate position.

25 9. The control valve system of claim 8 wherein when one of said first and second units is in said actuated position or said intermediate position and said pressurized fluid is removed from said inlet then said one unit is urged into said intermediate position by a respective return spring, and wherein when said pressurized fluid is restored to said inlet then said one unit is retained in said intermediate position

against said respective return spring in response to pressure built up in a respective crossover chamber.

10. The control valve system of claim 1 further comprising:

5 first and second return chambers disposed at the other end of said first and second movable valve units, respectively, wherein said first and second return chambers are coupled to said second and first crossover chambers, respectively.

11. A method of providing memory of a normal valve state and a faulted
10 valve state in a control valve system, wherein said control valve system includes a housing defining an inlet, an outlet and an exhaust, said inlet being adapted to receive pressurized fluid, wherein said control valve system includes a first movable valve unit including a first exhaust poppet and a first inlet poppet, wherein said first movable valve unit is movable to an actuated position, a deactuated position, and an
15 intermediate position, wherein said control valve system includes a second movable valve unit including a second exhaust poppet and a second inlet poppet, wherein said second movable valve unit is movable to an actuated position, a deactuated position, and an intermediate position, wherein said control valve system includes first and second crossover chambers communicating with said second and first inlet poppets,
20 respectively, wherein said control valve system includes first and second flow restrictors coupling said inlet to said first and second crossover chambers, respectively, wherein said control valve system includes first and second pilot valves disposed at one end of said first and second movable valve units, respectively, that are activated to selectably urge said first and second movable valve units to said respective actuated
25 positions, wherein a normal valve state is comprised of a movable valve unit being in said deactuated position when a respective pilot valve is not activated, and wherein said faulted valve state is comprised of a movable valve unit being in said actuated position or said intermediate position when a respective pilot valve is not activated, said method comprising the steps of:

when a movable valve unit is in said normal valve state, then balancing said movable valve unit at said deactuated position when said inlet pressure is cycled off and on; and

5 when a movable valve unit is in said faulted valve state, then latching said movable valve unit at said intermediate position when said inlet pressure is cycled off and on.

12. The method of claim 11 wherein said movable valve units are shaped such that pressurized fluid in said inlet generates substantially no net forces on said
10 movable valve units in their axial direction.

13. The method of claim 11 wherein said latching step comprises building pressure in a respective crossover chamber of one movable valve unit in a faulted valve state, said respective crossover chamber being sealed by the other movable valve
15 unit being in a normal valve state.